

CLAIMS

1. Droplet deposition apparatus comprising a body structure defining a central plane and in that plane a channel extension direction; a plurality of elongate droplet ejection channels extending through the body structure parallel to the central plane and in the channel extension direction, each channel being offset relative to the central plane with respect to the adjacent channel; a respective droplet ejection nozzle communicating with each channel; actuating means for generating an acoustic wave in a selected channel and thereby effecting drop ejection through the respective nozzle; a manifold extending through the body structure parallel to the central plane and orthogonal to the channel extension direction, the manifold intersecting each channel to define a channel end profile, the channel end profile of one channel being substantially a mirror image in the central plane of the channel end profile of the adjacent channel, so that the acoustic wave reflection coefficient of the boundary between each channel and the manifold is substantially equal for all channels.
2. Droplet deposition apparatus according to Claim 1, wherein each channel end profile includes a profile surface which is inclined with respect to the channel extension direction, the angle of inclination of the profile surface for one channel being equal and opposite to that of the adjacent channel.
3. Droplet deposition apparatus according to Claim 1 or Claim 2, wherein an electrically conductive track extends over part of the channel end profile for each channel.
4. Droplet deposition apparatus according to Claim 3, wherein said electrically conductive tracks are formed by through deposition of a continuous conductive layer and subsequent removal of material to delineate tracks.
5. Droplet deposition apparatus according to Claim 4, wherein said material is removed in a laser process.

6. Droplet deposition apparatus comprising a body structure defining a central plane and in that plane a channel extension direction; a plurality of elongate droplet ejection channels extending through the body structure parallel to the central plane and in the channel extension direction, a first group of channels being offset relative to the central plane in a first offset direction orthogonal to the central plane and a second group of channels being offset relative to the central plane in a second offset direction orthogonal to the central plane; a respective droplet ejection nozzle communicating with each channel; actuators comprising respective regions of piezoelectric material with electrodes connected to receive drive signals, each actuator on receipt of a drive signal serving to generate an acoustic wave in a selected channel and thereby effect drop ejection through the respective nozzle; a manifold extending through the body structure parallel to the central plane and orthogonal to the channel extension direction, the manifold intersecting each channel to define a channel end profile, with a conductive track extending over at least part of the channel end profile of each channel, these conductive tracks carrying drive signals to the electrodes, the channel end profile of the first group of channels being substantially a mirror image in the central plane of the channel end profile of the second group of channels, so that the acoustic wave reflection coefficient of the boundary between each channel and the manifold is substantially equal for all channels.

7. Droplet deposition apparatus according to Claim 6, wherein the cross section of the manifold is symmetric with respect to the central plane.

8. Droplet deposition apparatus according to Claim 6 or Claim 7, further comprising a first electrical drive circuit for providing a first drive waveform for actuating channels of the first group of channels and a second electrical drive circuit for providing a second drive waveform for actuating channels of the second group of channels, the first and second groups of channels being actuated alternately and the first drive waveform differing from the second drive waveform to that extent necessary to ensure equal velocity of drop ejection from a channel of the first group and a channel of the second group.

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9. Droplet deposition apparatus according to Claim 8, wherein the first drive waveform differs from the second drive waveform in drive voltage, in pulse rise or in pulse width.

10. Droplet deposition apparatus comprising a body structure defining a central plane and in that plane a channel extension direction; a plurality of elongate droplet ejection channels extending through the body structure parallel to the central plane and in the channel extension direction, a first group of channels being offset relative to the central plane in a first offset direction orthogonal to the central plane and a second group of channels being offset relative to the central plane in a second offset direction orthogonal to the central plane; a respective droplet ejection nozzle communicating with each channel; electrically actuatable means for generating an acoustic wave in a selected channel and thereby effecting droplet ejection through the respective nozzle; a manifold extending through the body structure parallel to the central plane and orthogonal to the channel extension direction, the manifold intersecting each channel, with the first group of channels having an acoustic wave reflection coefficient at the manifold which differs from the acoustic wave reflection coefficient at the manifold of the second group of channels; a first electrical drive circuit for providing a first drive waveform for actuating channels of the first group of channels and a second electrical drive circuit for providing a second drive waveform for actuating channels of the second group of channels, the first and second groups of channels being actuated alternately and the first drive waveform differing from the second drive waveform in that extent necessary to ensure equal velocity of drop ejection from a channel of the first group and a channel of the second group.

11. Droplet deposition apparatus according to Claim 10, wherein the first drive waveform differs from the second drive waveform in drive voltage, in pulse rise or in pulse width.

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12. A method of droplet deposition comprising the steps of providing a body structure defining a central plane and in that plane a channel extension direction; a plurality of elongate droplet ejection channels extending through the body structure parallel to the central plane and in the channel extension direction, each channel being offset relative to the central plane with respect to the adjacent channel; a respective droplet ejection nozzle communicating with each channel; and a manifold extending through the body structure parallel to the central plane and orthogonal to the channel extension direction, the manifold intersecting each channel to define a channel end profile; generating an acoustic wave in a first channel and thereby effecting drop ejection through the respective nozzle; generating an acoustic wave in a second channel adjacent to the first channel and thereby effecting drop ejection through the respective nozzle; and arranging that the acoustic wave reflection coefficient of the boundary between the first channel and the manifold is equal to that of the boundary between the second channel and the manifold.

13. A method according to Claim 12, wherein each channel end profile includes a profile surface which is inclined with respect to the channel extension direction, the angle of inclination of the profile surface for one channel being equal and opposite to that of the adjacent channel.

14. The use of droplet deposition apparatus comprising a body structure defining a central plane and in that plane a channel extension direction; a plurality of elongate droplet ejection channels extending through the body structure parallel to the central plane and in the channel extension direction, a first group of channels being offset relative to the central plane in a first offset direction orthogonal to the central plane and a second group of channels being offset relative to the central plane in a second offset direction orthogonal to the central plane; a respective droplet ejection nozzle communicating with each channel; electrically actuable means for generating an acoustic wave in a selected channel and thereby effecting droplet ejection through the respective nozzle; a manifold extending through the body structure parallel to the central plane and orthogonal to the channel extension direction, the manifold intersecting each channel,

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with the first group of channels having an acoustic wave reflection coefficient at the manifold which differs from the acoustic wave reflection coefficient at the manifold of the second group of channels; the use comprising the steps of alternately applying a first drive waveform to actuate selected channels of the first group of channels and a second drive waveform to actuate selected channels of the second group of channels, the first drive waveform differing from the second drive waveform in that extent necessary to ensure equal velocity of drop ejection from a channel of the first group and a channel of the second group.

15. The use according to Claim 14, wherein the first drive waveform differs from the second drive waveform in drive voltage, in pulse rise or in pulse width.

16. Droplet deposition apparatus comprising an actuator plate comprising a plurality of channels at a predetermined channel spacing, each of said channels having a predetermined length d_1 a portion of said length having a constant depth and a portion of said length having a changing depth; a nozzle plate providing an end wall of said actuator channels and said cover channels; wherein said actuator channels comprise acoustic reflection modifying means.

17. Droplet deposition apparatus comprising an actuator plate comprising a plurality of channels at a predetermined channel spacing, each of said channels having a predetermined length d_1 a portion of said length having a constant depth and a portion of said length having a changing depth; a cover plate comprising a plurality of channels at a predetermined channel spacing and having a channel length d_2 , where d_2 is less than d_1 ; at least one of said actuator channels being in registry with at least one of said cover channels; a nozzle plate providing an end wall of said actuator channels and said cover channels; wherein at least some of said actuator channels comprise acoustic reflection modifying means such that the acoustic reflection of an ejection channel formed of an actuator channel in registry with a cover channel is substantially identical to the acoustic reflection of an ejection channel formed of an actuator channel which is not in registry with a cover channel.

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18. Apparatus according to Claim 16 or Claim 17, wherein the acoustic reflection modifying means comprise a groove extending transverse to the length of the actuator channels.

19. Apparatus according to Claim 18, wherein the transverse groove is filled with an ejection fluid.

20. Apparatus according to Claim 18, wherein the transverse groove is filled with an acoustically transparent solid.

21. Apparatus according to Claim 20, wherein the acoustically transparent solid is an adhesive material, preferably an epoxy.